

Two new and four newly recorded species of *Simulium* (Diptera: Simuliidae) from Mindoro Island, the Philippines

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Abstract: Eight species of black flies including two new and four newly recorded ones were collected from Mindoro Island, the Philippines. One of the two new species, *Simulium* (*Gomphostilbia*) *mindoroense* sp. nov., described from the adults, pupae and mature larvae, represents the first species of the *ceylonicum* species-group so far recorded from the Philippines, and the second, *S.* (*Simulium*) *halconense* sp. nov., described from the adult female and pupa, is assigned to the *melanopus* species-group. Four species newly recorded from Mindoro Island are *S.* (*S.*) *baltazarae* Delfinado, *S.* (*S.*) *taalense* Takaoka, *S.* (*Wallacellum*) *suyoense* Takaoka and *S.* (*W.*) *tuyense* Takaoka.

Key words: *Simulium*, black fly, Simuliidae, Mindoro, Philippines, description

The black-fly fauna of Mindoro Island, the Philippines, consists of only two species, *Simulium* (*Gomphostilbia*) *baisasae* Delfinado and *S.* (*Simulium*) *discrepans* Delfinado (Takaoka, 1983).

Recently we collected a total of eight species of black flies from the eastern parts of Mindoro Island, consisting of two known, two new and four newly recorded species. In this paper, these two new species are described on the basis of the reared adults, pupae and/or mature larvae, and four other species newly recorded from Mindoro Island are noted.

The keys provided by Takaoka (1983) were used for species identification. The terms for morphological features used here follow those of Takaoka (2003). Holotype and paratype specimens of the new species are deposited at the Department of Infectious Disease Control, Faculty of Medicine, Oita University, Oita, Japan.

THE SPECIES OF SIMULIIDAE OF MINDORO ISLAND

1. *Simulium* (*Gomphostilbia*) *baisasae* Delfinado

Simulium baisasae Delfinado, 1962: 53–57.

Simulium (*Eusimulium*) *baisasae*: Delfinado, 1969: 206.

Simulium (*Gomphostilbia*) *baisasae*: Delfinado, 1971: 137; Takaoka, 1983: 77–80.

SPECIMENS EXAMINED. 2 females and 2 males, all reared from pupae, collected from a main channel (width 2–5 m, stream bed rocky, water temperature 27°C, shaded, altitude 212 m), just above Tamalaw Falls, Villa Flor, Puerto Galera, Mindoro Oriental, 17. IX. 2006.

DISTRIBUTION. Philippines (Luzon and Mindoro).

2. *Simulium (Gomphostilbia) mindoroense* sp. nov.

DESCRIPTION. Female. Body length about 2.0 mm. **Head.** Slightly narrower than width of thorax. Frons dark brown, thinly grayish-white pruinose, shiny at certain angle of light, densely covered with yellowish-white scalelike recumbent short hairs interspersed with several dark simple longer hairs along each lateral margin; frontal ratio 1.63:1.00:2.44; frons-head ratio 1.0:5.0. Fronto-ocular area (Fig. 1A) well developed, narrow, directed dorsolaterally. Clypeus dark brown, grayish-white pruinose, densely covered with yellowish-white scalelike recumbent short hairs interspersed with 8 or 9 dark longer hairs on each side of lower 2/3. Labrum 0.67 times as long as clypeus. Antenna composed of scape, pedicel and 9 flagellomeres, light to dark brown (gradually darkened from base to apex) except scape, pedicel and base of 1st flagellomere whitish-yellow when viewed dorsally; 1st flagellomere almost entirely whitish-yellow to dark yellow when viewed ventrally. Maxillary palp composed of 5 segments, light to medium brown, proportional lengths of 3rd, 4th, and 5th segments 1.0:1.0:2.5; 3rd segment (Fig. 1B) swollen; sensory vesicle (Fig. 1B) oblong, 0.62 times as long as 3rd segment, with medium-sized opening medially. Maxillary lacinia with 7 or 8 inner teeth and 11 or 12 outer ones. Mandible with about 22 inner teeth and 7 or 8 outer ones. Cibarium (Fig. 1C) medially forming round sclerotized plate folded forward from posterior margin, and with moderately sclerotized medial longitudinal ridge. **Thorax.** Scutum dark brown to brownish-black (except anterior calli medium brown), shiny, thinly grayish-white pruinose with 3 faint non-pruinose longitudinal vittae (1 medial and 2 submedial) when illuminated dorsally and viewed anteriorly or posteriorly, moderately covered with yellowish-white scalelike recumbent hairs, and with 1 or 2 dark long upright hairs near each posterolateral margin. Scutellum dark brown, covered with copper-colored short hairs as well as dark long upright hairs along posterior margin. Postnotum dark brown, bare. Pleural membrane bare. Katepisternum medium brown, longer than deep, moderately covered with white and dark hairs. **Legs.** Foreleg: coxa whitish-yellow; trochanter dark yellow or light brown except

base whitish-yellow; femur light to medium brown; tibia white on basal 3/4 and brownish-black on apical 1/4; tibia densely covered with whitish fine hairs on outer surface of basal 3/4; tarsus brownish-black, with moderate dorsal hair crest; basitarsus moderately dilated, 5.0 times as long as its greatest width. Midleg: coxa medium brown except posterolateral surface dark brown; trochanter light brown except base yellowish-white; femur medium brown; tibia dark brown except basal 1/3 white; tarsus medium to dark brown except basal 1/3 to 2/5 dark yellow or light brown. Hind leg: coxa medium brown; trochanter whitish-yellow; femur medium to dark brown with extreme base whitish-yellow; tibia light to dark brown except slightly less than basal 1/2 white; tibia densely covered with white fine hairs on posterior and outer surfaces of basal 3/4; tibia moderately angulate posteriorly at apical 3/10 when viewed laterally; tarsus medium brown except slightly less than basal 2/3 of basitarsus and basal 1/2 of 2nd tarsal segment yellowish-white; basitarsus (Fig. 1D) narrow, nearly parallel-sided, 5.85 times as long as wide, and 0.69 and 0.61 times as wide as greatest widths of tibia and femur, respectively; calcipala nearly as long as wide, and 0.52 times as wide as greatest width of basitarsus. All femora, tibiae and parts of tarsus densely covered with dark (and also pale) scalelike hairs. Claw (Fig. 1E) with large basal tooth 0.44 times as long as claw. **Wing.** Length about 1.9 mm. Costa with dark spinules as well as light brown hairs intermixed with pale hairs near base. Subcosta with dark hairs except near apex bare. Hair tuft on stem vein medium brown. Basal portion of radius fully haired; R_1 with spines and hairs; R_2 with hairs only. Basal cell absent. **Abdomen.** Basal scale light brown, with fringe of whitish-yellow hairs. Abdomen medium brown to brownish-black except basal 1/2 of segment 2 whitish-yellow, moderately covered with copper-colored short and dark brown long hairs; tergites of segments 2 and 6–9 wide and shiny, while those of segments 3–5 narrow, nearly quadrate, subequal in shape and size to one another, and all dull; ventral surface of segment 2 entirely pale whitish-yellow, and those of other segments light to medium brown; sternal plate on segment 7 undeveloped. **Genitalia.** Sternite 8 (Fig. 1F) bare medially, with 20–24 short to long hairs on each side. Ovipositor valves (Fig. 1F) tongue-

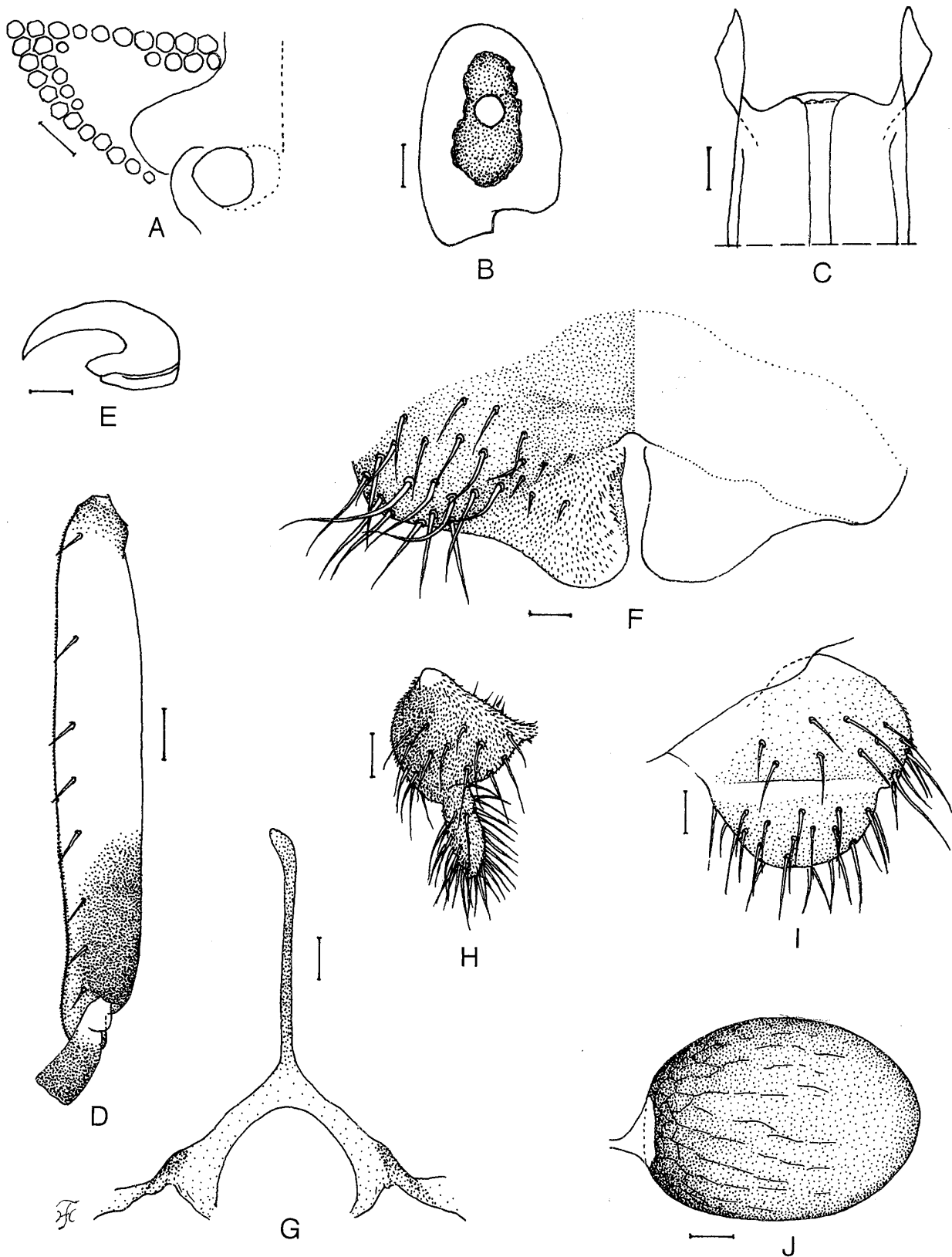


Fig. 1. Female of *Simulium* (*Gomphostilbia*) *mindoroense* sp. nov. A, fronto-ocular area (right side); B, 3rd segment of maxillary palp with sensory vesicle (right side; front view); C, cibarium; D, basitarsus and 2nd tarsal segment of hind leg showing calcipala and pedisulcus (left side; outer view); E, claw; F, 8th sternite and ovipositor valves *in situ* (ventral view); G, genital fork (ventral view); H and I, paraprocts and cerci *in situ* (right side; H, ventral view; I, lateral view); J, spermatheca. Scale bars. 0.05 mm for D; 0.03 mm for A; 0.02 mm for B, C and F–J; 0.01 mm for E.

like, with round medioposterior corners, thin, membranous, moderately covered with microsetae interspersed with 2–4 short setae; inner margins slightly sinuous, moderately sclerotized, and moderately separated from each other. Genital fork (Fig. 1G) of usual inverted-Y form, with arms of moderate width; arm moderately folded medially and with projection directed posteromedially. Paraproct in ventral view (Fig. 1H) nearly triangular, pointed medially, and with about 5 sensilla on anteromedial surface; paraproct in lateral view (Fig. 1I) somewhat produced ventrally, with 14–16 medium-long to long hairs on ventral and lateral surfaces. Cercus in lateral view (Fig. 1I) short, rounded posteriorly, 0.44 times as long as wide. Spermatheca (Fig. 1J) ellipsoidal, 1.35 times as long as wide, well sclerotized except duct and small area near juncture to duct unsclerotized, and with many fissures on surface; internal setae absent; both accessory ducts slender, subequal in diameter to major one.

Male. Body length 2.0–2.1 mm. **Head.** Wider than thorax. Upper eye consisting of 12 vertical columns and 13 horizontal rows of large facets. Face dark brown, white pruinose. Clypeus dark brown, densely covered with yellow scalelike short to medium-long hairs (mostly directed upwards) interspersed with several dark brown simple longer hairs near lower margin. Antenna composed of scape, pedicel and 9 flagellomeres, light to medium brown except scape, pedicel and base of 1st flagellomere yellow; 1st flagellomere elongate, about 1.8 times as long as 2nd one. Maxillary palp with 5 segments, light brown, proportional lengths of 3rd, 4th, and 5th segments 1.0 : 1.4 : 3.5; sensory vesicle (Fig. 2A) nearly globular, small, 0.24 times as long as 3rd segment, and with small opening. **Thorax.** Scutum dark brown, thinly grayish-white pruinose on shoulders, along lateral margins and on prescutellar area, with median large area non-pruinose, shiny, and densely covered with yellow scalelike recumbent hairs intermixed with brown similar hairs anteriorly, and with 1 or 2 dark long upright hairs on each posterolateral margin; scutellum dark brown, with copper-colored short hairs and dark brown long upright hairs along posterior margin. Postnotum dark brown, shiny, grayish-white pruinose and bare. Pleural membrane bare. Katepisternum medium brown, longer than deep, moderately covered with yellow and dark short hairs.

Legs. Colors nearly similar to those of female legs except fore tibia with more darker area along inner surface, mid tibia white on slightly less than basal 1/3, hind tibia white on basal 1/3 (also white hair covering only on basal 1/3), and hind basitarsus yellowish-white on slightly less than basal 2/5, and 2nd hind tarsal segment white on basal 1/3. Fore basitarsus somewhat dilated, 6.1 times as long as its greatest width. Hind basitarsus (Fig. 2B) enlarged, wedge-shaped, gradually widened toward apex, 3.33 times as long as wide, and 0.91 and 1.00 times as wide as greatest widths of tibia and femur, respectively; calcipala small, nearly as long as wide, and 0.29 times as wide as greatest width of basitarsus. **Wing.** Length 1.7 mm; other characters as in female except subcosta bare. **Abdomen.** Basal scale dark brown, with fringe of light brown hairs. Dorsal surface of abdomen medium brown to brownish-black except basal 2/3 of 2nd segment yellow to dark yellow, covered with dark short to long hairs; segments 2 and 5–8 each with pair of shiny dorsolateral or lateral patches, of which those on segment 2 broadly connected in middle to each other, and those on segments 5–7 narrowly connected to each other along anterior margin. **Genitalia.** Coxite in ventral view (Fig. 2C) nearly rectangular, about twice as long as wide. Style in ventral view (Fig. 2C) slender, tapered toward apex, 0.83 times as long as coxite, gently bent inward, with apical spine; style in ventrolateral view (Fig. 2D) gradually tapered toward apex, with blunt apex. Ventral plate in ventral view (Fig. 2C), transverse, 0.63 times as long as wide, somewhat widened anteriorly (though posterior 2/5 narrowed), with anterior margin produced anteromedially, and posterior margin nearly straight or slightly convex medially, and densely covered with microsetae on ventral surface except near anterior and lateral margins bare; basal arms of moderate length, somewhat diverged basally, then slightly converged apically; ventral plate in lateral view (Fig. 2E) much produced ventrally; ventral plate in end view (Fig. 2F) rounded ventrally but almost straight near apex, and densely covered with microsetae on posterior surface. Median sclerite (Fig. 2G) thin, platelike, wide. Paramere (Fig. 2H,I) of moderate size, each with 3 distinct long and stout hooks and several smaller ones close together near apex. Aedeagal membrane (Fig. 2I) moderately or

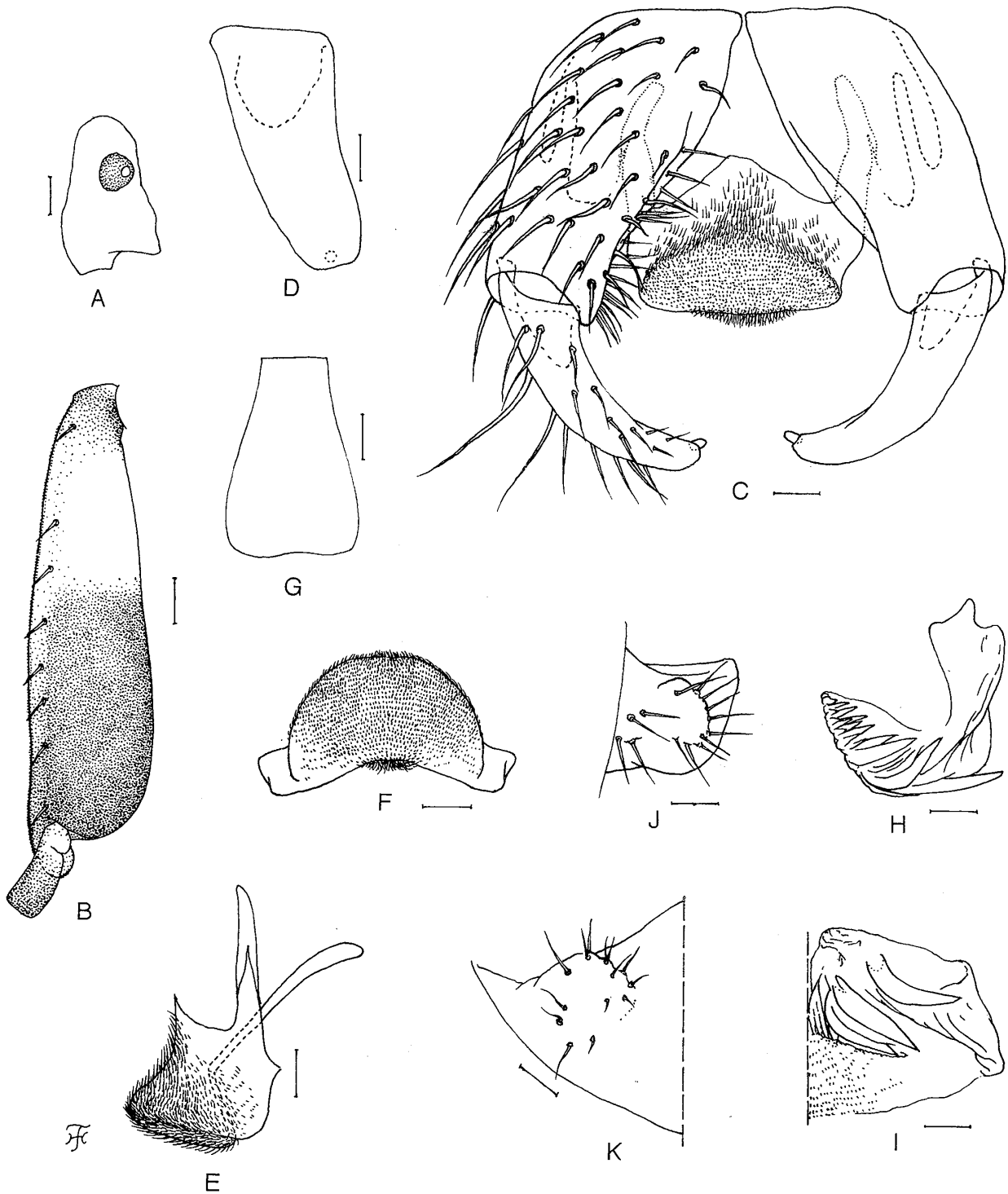


Fig. 2. Male of *Simulium* (*Gomphostilbia*) *mindoroense* sp. nov. A, 3rd segment of maxillary palp with sensory vesicle (right side; front view); B, basitarsus and 2nd tarsal segment of hind leg showing calcipala and pedisulcus (left side; outer view); C, coxites, styles and ventral plate *in situ* (ventral view); D, style (right side; ventrolateral view); E, ventral plate and median sclerite (lateral view); F, ventral plate (end view); G, median sclerite (end view); H, paramere (left side; dorsal view); I, paramere and aedeagal membrane (left side; end view); J and K, cerci (right side; J, lateral view; K, end view). Scale bars. 0.05 mm for B; 0.02 mm for A and C-K.

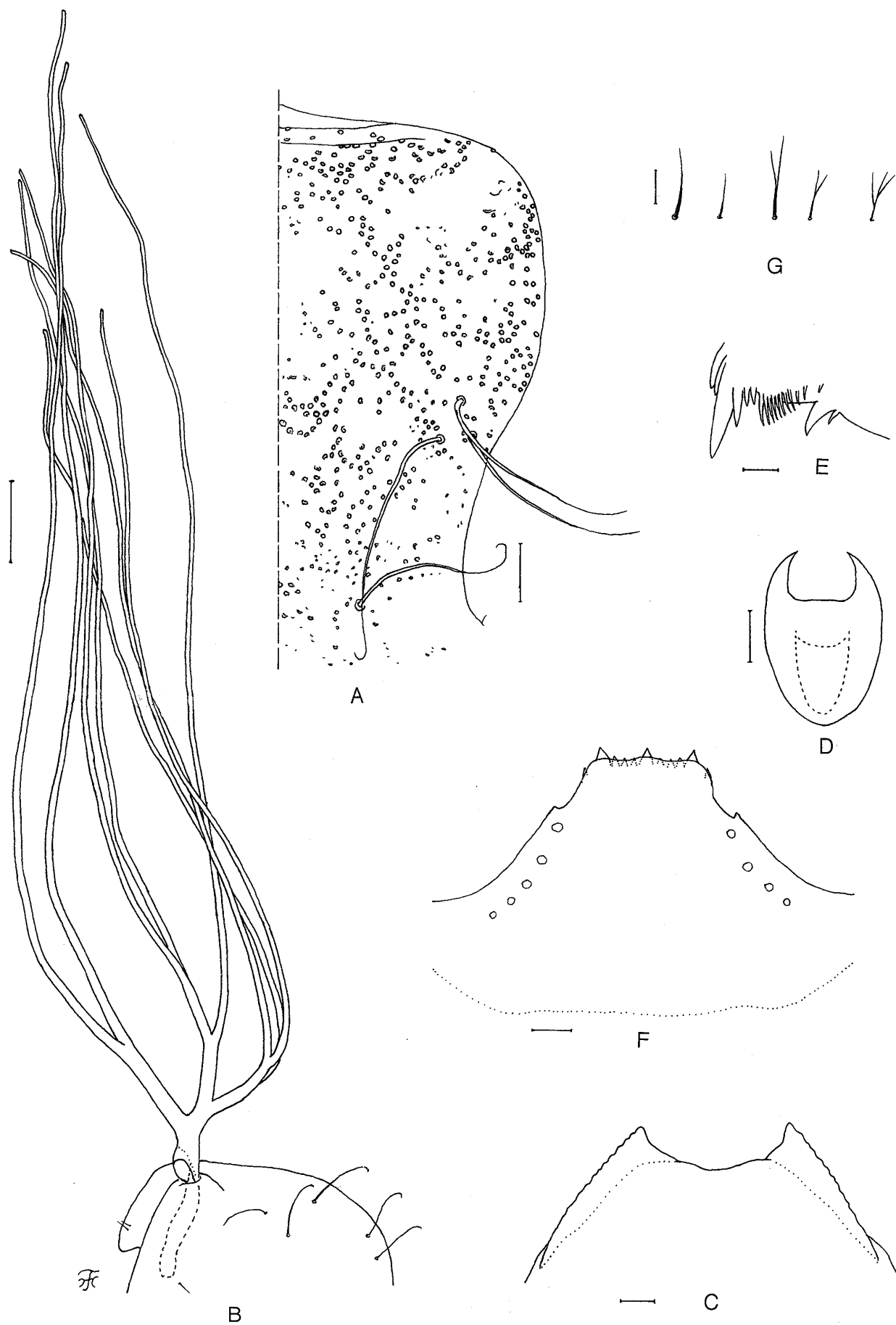
sparsely setose. Ventral surface of 10th abdominal segment thinly sclerotized anteriorly, without distinct hairs near posterior margin on each side. Cercus (Fig. 2J, K) rounded, encircled with 12–14 hairs.

Pupa. Body length 2.2–2.4 mm. **Head.** Integument (Fig. 3A) light yellow, moderately covered with round tubercles; antennal sheath normal, with no spinous projections, and bare; face with pair of simple very long trichomes with coiled or uncoiled apex, and frons with 3 pairs of simple very long trichomes with coiled or uncoiled apex; 3 frontal trichomes on each side arising close together, subequal in length to one another and slightly longer than facial one. **Thorax.** Integument light yellow, moderately or sparsely covered with round tubercles, with 3 pairs of simple very long trichomes with coiled apex dorsomedially, with 2 pairs of simple very long trichomes (1 with coiled apex, 1 with uncoiled apex) anterolaterally, with pair of simple medium-long trichomes with apex uncoiled posterolaterally, and with 3 pairs of simple short or medium-long trichomes with apex uncoiled ventrolaterally. Gill (Fig. 3B) composed of 8 slender threadlike filaments, longer than pupal body, arranged in [(1+2)+(1+2)]+2 filaments from dorsal to ventral, with somewhat swollen transparent organ ventrally (partially broken); upper and middle triplets sharing short stalk arising from short common basal stalk; each triplet composed of 1 individual and 2 paired filaments with short stalk; stalk of ventral paired filaments of medium length, nearly as thick as interspiracular trunk, slightly thicker than primary stalk of middle triplet which is slightly thicker than that of dorsal triplet; stalk of upper triplet lying against that of lower pair nearly at right angle when viewed laterally; all filaments light yellow except dorsal and dorsolateral surfaces of common basal stalk dark brown, gradually tapered toward apical tip, slightly different in length with ventral paired filaments longest (2.7–3.2 mm), filaments of dorsal triplet shortest (2.2–2.5 mm) and those of middle triplet intermediate in length; cuticle of all fil-

aments with distinct annular ridges and furrows though becoming indistinct on apical 1/2 of their length, densely covered with minute tubercles. **Abdomen.** Dorsally, segment 1 pale yellow, almost bare, with 1 simple slender medium-long hairlike seta on each side; segment 2 pale yellow, bare, with 1 simple slender medium-long hairlike seta and 5 very short somewhat spinous setae, submedially on each side; segments 3 and 4 mostly transparent, each with 4 hooked spines and 1 very short somewhat spinous seta on each side; segment 5 lacking spine-combs; segments 6–9 each with distinct spine-combs in transverse row, together with comb-like groups of minute spines on each side; segment 9 with pair of distinct flat platelike terminal hooks extending laterally at base and having weakly serrated outer margin (Fig. 3C). Ventrally, segment 4 with 1 simple short somewhat spinous seta and a few simple slender very short setae on each side; segment 5 with pair of bifid or trifid hooks submedially and a few very short simple slender setae on each side; segments 6 and 7 each with pair of bifid inner and simple outer hooks somewhat spaced from each other and a few very short simple slender setae on each side; segments 4–8 with comb-like groups of minute spines. Each side of segment 9 with 3 grapnel-like hooklets. **Cocoon** (Fig. 3D). Wall-pocket-shaped, thinly and neatly woven, extending ventrolaterally; anterior margin somewhat thickly woven, without anterodorsal bulge or projection; posterior 1/2 with floor moderately woven; individual threads visible or not; 3.2–3.5 mm long by 2.2–2.5 mm wide.

Mature larva. Body length 4.5–4.8 mm. Body (Fig. 4A, B) white to yellowish-white, though all surfaces of abdominal segments 1–4 and ventral surface of thoracic segments 2 and 3 somewhat grayish in most larvae, and with reddish-brown markings as follows; broad transverse band encircling thoracic segment 1 though often disconnected ventrally, dorsolateral transverse spot on each side of abdominal segments 1–4, gradually becoming smaller and less distinct from posterior to anterior seg-

Fig. 3. Pupa and mature larva of *Simulium (Gomphostilbia) mindoroense* sp. nov. A–D, pupa, and E–G, larva. A, frons and portion of face (left half); B, gill filaments and anterior part of thoracic integument (left side; outer view); C, terminal hooks (end view); D, cocoon (dorsal view); E, apex of mandible; F, hypostoma; G, dark simple, bifid and trifid minute setae on dorsal and dorsolateral surface of posterior abdominal segments. Scale bars. 1.0 mm for D; 0.2 mm for B; 0.05 mm for A; 0.02 mm for F; 0.01 mm for C, E and G.



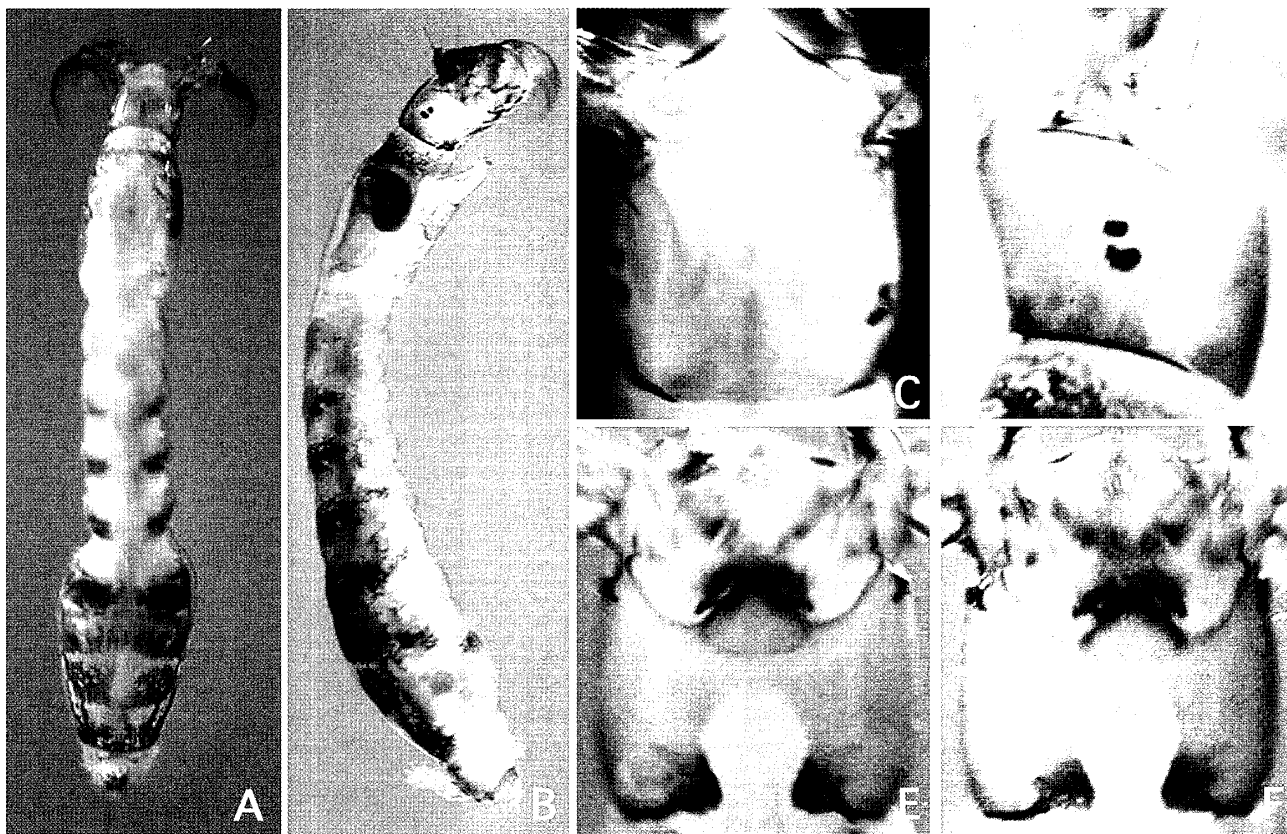


Fig. 4. Mature larva of *Simulium* (*Gomphostilbia*) *mindoroense* sp. nov. A and B, whole body showing colored markings (A, dorsal view; B, lateral view); C–F, head capsules (C, dorsal view; D, lateral view; E and F, ventral view); E and F showing the apex of the postgenal cleft approaching to and reaching the posterior margin of the hypostoma, respectively.

ments, and even absent on segment 1 (and also on segment 2) in most of larvae, and those on segments 3 and 4 extending ventrolaterally and even connected on ventral surface to each other, and wide markings covering almost entirely dorsal and dorsolateral surfaces of segments 5–9 and extending further ventrolaterally on segments 5 and 6, and broad transverse band on ventral surface of segment 7; body relatively narrow medially from 1st to 4th abdominal segments, widest near border between 5th and 6th abdominal segments, and with intersegmental constriction marked from 1st to 5th abdominal segments. Cephalic apotome (Fig. 4C) yellowish except anterior portion pale white; head spots positive though anterior and posterior mediolongitudinal spots and posterior spots of posterolateral spots moderately distinct and mediolateral spots faintly positive or appearing merged into background, and anterior spots of posterolateral spots indistinct or even appearing negative. Lateral surface of head capsule (Fig. 4D) yellowish except eye-spot region whitish; 2 large

spots and 1 small spot just before posterior margin and 1 small spot below eye-spot region faintly positive. Ventral surface of head capsule (Fig. 4E, F) yellowish, with faintly positive transverse spot on each side of postgenal cleft. Antenna composed of 3 segments and apical sensillum, somewhat longer than stem of labral fan; proportional lengths of 1st, 2nd, and 3rd segments 1.00:0.76:0.92–1.00. Labral fan with 35–38 main rays. Mandible (Fig. 3E) with 1st comb-tooth much longer than 2nd and 3rd comb-teeth, which are subequal in length; mandibular serration composed of 2 teeth (1 large and 1 small); large tooth at acute angle against mandible on apical side; supernumerary serrations absent. Hypostoma (Fig. 3F) with row of 9 apical teeth; median and each corner tooth prominent, subequal in length to each other, and much longer than 3 intermediate teeth on each side; lateral margin smooth; 4 or 5 hypostomal bristles per side, lying subparallel to lateral margin. Postgenal cleft (Fig. 4E, F) arrow-head shaped, markedly constricted basally, widest medially, pointed

apically, very deep, approaching posterior border of hypostoma thus leaving narrow postgenal bridge (Fig. 4E) in most larvae or reaching posterior border of hypostoma (Fig. 4F) in 1 larva. Cervical sclerite composed of 2 small pale rod-like pieces, not fused to occiput, widely separated medially from each other. Thoracic cuticle bare. Abdominal cuticle almost bare on segments 1–4 and moderately covered with simple dark minute setae intermixed with bifid (very rarey trifid) dark minute setae (Fig. 3G) on dorsal and dorsolateral surfaces of segments 5–9, and also moderately covered with simple colorless minute setae on each side of anal sclerite of last segment. Rectal scales appear to be absent. Rectal papilla compound, each of 3 lobes with 8–10 finger-like secondary lobules. Anal sclerite of usual X-form, with anterior arms slightly shorter than posterior ones, broadly sclerotized at base; accessory sclerite absent; basal juncture area with no sensilla. Last abdominal segment expanded ventrolaterally forming double bulges on each side, visible as a large conical ventral papilla when viewed from side. Posterior circlet with 74–78 rows of up to 14 hooklets per row.

TYPE SPECIMENS. Holotype female, reared from pupa, collected from a tributary, just above Tamalaw Falls, Villa Flor, Puerto Galera, Mindoro Oriental, Philippines, 17. IX. 2006. Paratypes: 2 females, 2 males, 8 mature larvae, same data as those of holotype.

ECOLOGICAL NOTES. The pupae and larvae of this new species were taken from trailing grass leaves and fallen dead leaves in slow-flowing small stream (width 20–30 cm, shaded, water temperature 25.0°C, altitude 213 m). One pupa of *S. (S.) baltazarae* and one immature larva of *Simulium (Wallacellum)* sp. were collected together from the same stream.

ETYMOLOGY. The species name *mindoroense* refers to the name of the island, Mindoro, where this new species was collected.

REMARKS. *Simulium (G.) mindoroense*

sp. nov. is readily assigned to the *ceylonicum* species-group within the subgenus *Gomphostilbia* by having the enlarged male hind basitarsus (Fig. 2B). This is the first record of this species-group from the Philippines.

This new species is very similar to *S. (G.) ambonense* from Ambon and Seram, Indonesia (Takaoka, 2003), *S. (G.) ela* from Sri Lanka (Davies and Györkos, 1987) and *S. (G.) sheilae* originally described from Peninsular Malaysia (Takaoka and Davies, 1995), in many characters including the enlarged sensory vesicle in the female, the reduced number of large eye facets in the male, and the deep postgenal cleft in the larva. However, this new species is distinguished from *S. (G.) ambonense* and *S. (G.) sheilae* by the following characters (those of the latter two species in parentheses): the relative length of the basal tooth to female claw 0.44 (Fig. 1E) (0.53 or 0.5), the male scutum whitish-gray pruinose on the shoulders, along lateral margins and on the prescutellar area (entirely whitish-gray or silvery pruinose), the common stalk of the dorsal and middle triplets of pupal gill filaments short (Fig. 3B) (very short), the terminal hooks flat, platelike and with weakly serrated outer margin (Fig. 3C) (conical or platelike with undulate outer margin), and the simple or bifid dark minute setae on the posterior segments of larval abdomen (Fig. 3G) (dark minute setae with 2–4 or 2–6 branches). This new species is distinguished from *S. (G.) ela* by the following characters (those of *S. (G.) ela* in parentheses): relative length of the male hind basitarsus to its greatest width 3.33 (2.7), and the rectal papillae compound, each lobe with 8–10 secondary lobules (simple, without secondary lobules).

3. *Simulium (Simulium) baltazarae* Delfinado

Simulium baltazarae Delfinado, 1962: 50–53.

Simulium (Simulium) nobile (not de Meijere): Delfinado, 1969: 203.

Simulium (Simulium) baltazarae: Delfinado, 1971: 132; Takaoka, 1983: 120–124.

SPECIMENS EXAMINED. 26 females and 20 males, all reared from pupae, 16 mature larvae, collected from the same river as noted for *S. (G.) baisasae*; 1 male reared from a pupa, collected from the same tributary as noted for *S. (G.) mindoroense* sp. nov.; 6 females and 3 males, all reared from pupae, and 8 mature larvae, collected from a small stream (width 1.5–3.0 m, shaded, water temperature 25.0°C, altitude 78 m), Dulangan III, Baco, foot of Mt. Halcon, Mindoro Oriental, 16. IX. 2006.

DISTRIBUTION. Philippines [Cebu, Negros, Luzon, Samar, Leyte, Mindanao and Mindoro (**new record**)].

4. *Simulium (Simulium) discrepans* Delfinado

Simulium (Simulium) discrepans Delfinado, 1969: 202; Takaoka, 1983: 96–99.

SPECIMENS EXAMINED. 3 females and 2 males, all reared from pupae, and 5 mature larvae, collected from the same main channel as noted for *S. (G.) baisasae*.

DISTRIBUTION. Philippines (Bohol, Cebu, Negros, Leyte, Luzon, Mindoro and Panay).

5. *Simulium (Simulium) halconense* sp. nov.

DESCRIPTION. Female. Body length 2.5 mm. **Head.** Narrower than width of thorax. Frons brownish-black, shiny, with several dark stout hairs along lateral margins; frontal ratio 1.24:1.00:1.29; frons-head ratio 1.0:4.1. Fronto-ocular area (Fig. 5A) well developed, directed laterally and rounded apically. Clypeus brownish-black, slightly shiny, whitish-gray pruinose, moderately covered with dark stout hairs except mediolongitudinal area bare; clypeus silvery iridescent when illuminated at certain angle of light. Labrum 0.6 times as long as clypeus. Antenna composed of

2+9 segments, dark brown except scape, pedicel, and base of 1st flagellar segment yellow. Maxillary palp medium brown, composed of 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.0:1.1:2.3; 3rd segment (Fig. 5B, C) not enlarged; sensory vesicle (Fig. 5B, C) small, globular or ellipsoidal, 0.21–0.23 times as long as 3rd segment, with medium-sized round opening submedially or apically. Maxillary lacinia with 13 inner and 12 outer teeth. Mandible with 27 inner and 11 or 12 outer teeth. Cibarium (Fig. 5D) with about 56 minute tubercles. **Thorax.** Scutum brownish-black, shiny, not patterned, moderately covered with ocherous very fine short hairs intermixed with dark brown slightly longer hairs and dark brown long upright hairs on prescutellar area. Scutellum medium brown, shiny, with dark brown long upright hairs as well as dark brown short hairs. Postnotum dark brown, shiny, white pruinose when illuminated at certain angle of light and bare. Pleural membrane bare. Katepisternum longer than deep, dark brown, bare, shiny when illuminated. **Legs.** Medium brown to brownish-black except fore coxa, basal 3/4 of mid basitarsus, slightly more than basal 3/5 of hind basitarsus and basal 1/2 of hind 2nd tarsal segment yellowish-white; all tibiae with silvery sheen on outer surface (fore tibia) or on posterior surface (mid and hind tibiae) when illuminated at certain angle of light. Fore tarsus with thick dorsal hair crest; basitarsus greatly dilated, 4.6 times as long as its greatest width. Hind basitarsus (Fig. 5E) nearly parallel-sided, 5.57 times as long as its greatest width, 0.70 and 0.65 times as wide as greatest widths of hind tibia and femur, respectively; calcipala nearly as long as width at base, and 0.43 times as wide as greatest width of basitarsus; pedisulcus distinct; tarsal claw (Fig. 5F) with small subbasal tooth. **Wing.** Length 1.7 mm. Costa with spinules and hairs. Subcosta haired except apical 1/4 or 2/5 bare. Basal section of vein R bare; R₁ with spinules and hairs; R₂ with hairs only. Hairs at base of stem vein dark brown. Basal cell absent. **Abdomen.** Basal scale dark brown, with fringe of long hairs. Dorsal surface of abdominal segments brownish-black except most of segment 2 medium brown, with dark hairs; 2nd segment with pair of large whitish iridescent dorso-lateral spots broadly connected to each other medially; tergites 5–9 shiny. Ventral surface of abdominal segment 7 without sternal plate.

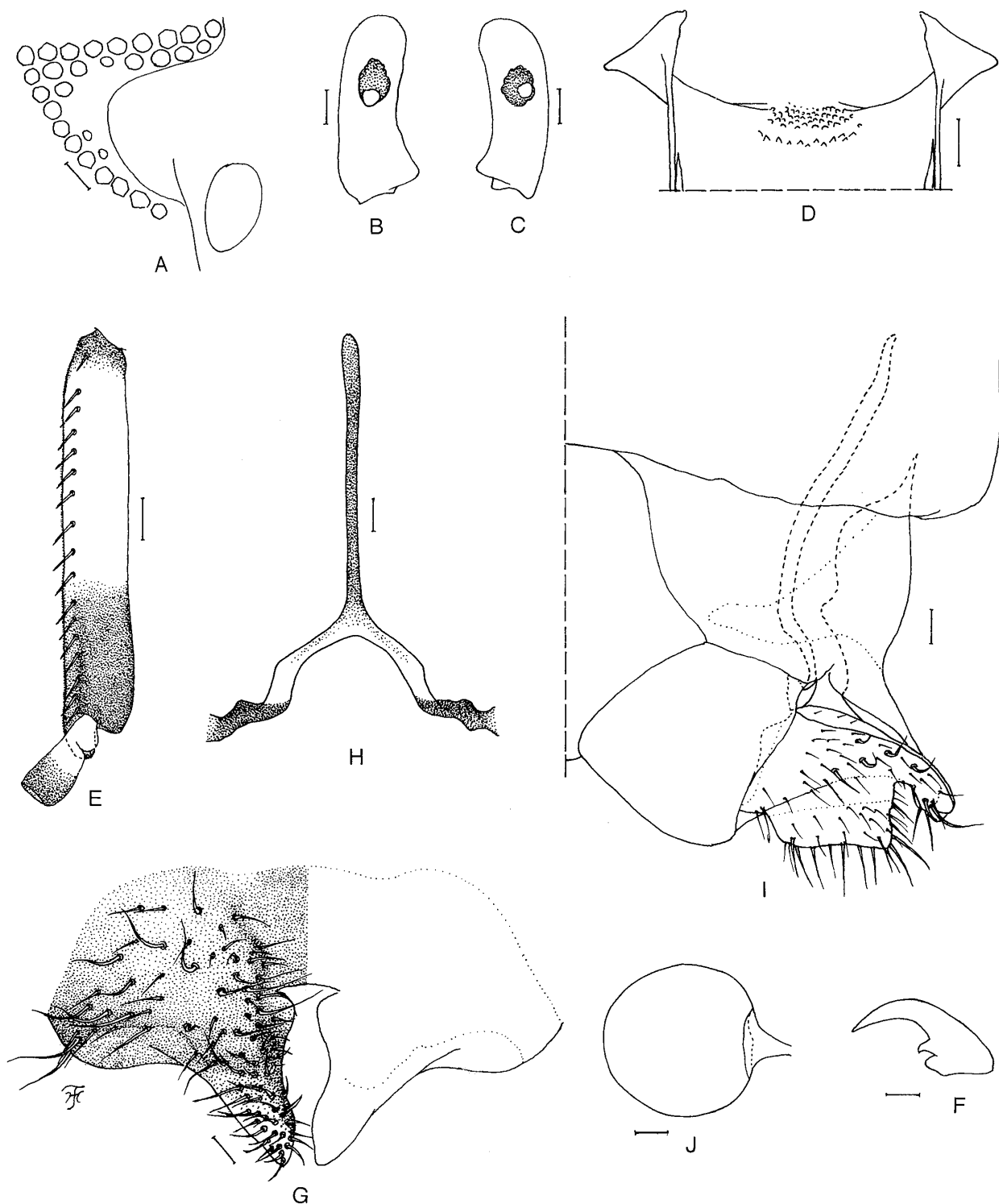


Fig. 5. Female of *Simulium* (*Simulium*) *halconense* sp. nov. A, fronto-ocular area (right side); B and C, 3rd segments of maxillary palp with sensory vesicle (front view; B, right side; C, left side); D, cibarium; E, basitarsus and 2nd tarsal segment of hind leg showing calcipala and pedisulcus (left side; outer view); F, claw; G, 8th sternite and ovipositor valves *in situ* (ventral view); H, genital fork (ventral view); I, paraproct, cercus, 8th sternite, and genital fork *in situ* (right side; lateral view); J, spermatheca. Scale bars. 0.05 mm for E; 0.02 mm for A-D and G-J; 0.01 mm for F.

Genitalia. Sternite 8 (Fig. 5G) well sclerotized, moderately depressed medially, moderately covered with long stout and medium-long fine hairs on each side, with posterior margin much produced posteriorly forming elongate lobes which are not well demarcated from ovipositor valves; these lobes (fused with ovipositor valve)(Fig. 5G) bluntly pointed posteriorly, slightly bent ventrally, and covered with numerous short to long hairs on ventral surface; inner margins well sclerotized, slightly concave medially, moderately separated from each other. Genital fork (Fig. 5H) of inverted-Y form; stem slender and well sclerotized; arms slender, each with strongly-sclerotized angulate lateral ridge. Paraproct in lateral view (Fig. 5I) much produced ventroposteriorly, 1.8 times as wide as its basal length, covered with several long stout hairs and numerous short fine hairs on lateral surface; paraproct in ventral view anteroventrally with thin elongate moderately-sclerotized plate having round apical tip and about 8 minute setae scattered on its surface. Cercus in lateral view (Fig. 5I) nearly rectangular, 1.8 times as wide as long and covered with numerous hairs. Spermatheca (Fig. 5J) globular, well sclerotized except duct and area of juncture to duct unsclerotized, with very faint reticulate surface patterns near base; minute internal setae present; both accessory ducts subequal in diameter to each other, and also to main duct.

Pupa. Body length (excluding gill filaments) about 2.6 mm. **Head.** Integument yellow to yellowish-brown, moderately covered with round tubercles in neat order; antennal sheath moderately covered with round tubercles at least basally, and narrow space between antennal sheath and frons also moderately covered with round tubercles; frons with 2 simple slender medium-long trichomes (Fig. 6A) very widely separated from each other (distance 0.07 mm, slightly shorter than twice the length of frontal trichomes) on left side, but only 1 similar trichome on right side; face with 1 simple slender medium-long trichome (Fig. 6B) on each side. **Thorax.** Integument yellow to yellowish-brown, densely or moderately covered with round tubercles and/or cone-shaped smaller tubercles; thorax with 2 simple slender long trichomes (Fig. 6C) dorsomedially, 2 simple slender long trichomes (Fig. 6D) anterolaterally, 1 simple somewhat stout medium-long trichome (Fig. 6E) posterolaterally, and 3

simple trichomes (1 medium-long and slender, 1 medium-long and somewhat stout, 1 long and somewhat stout) (Fig. 6F) ventrolaterally on each side. Gill (Fig. 6G, H) with 6 slender threadlike filaments in pairs; dorsal and ventral pairs very short-stalked while middle pair almost sessile; all filaments subequal in thickness and slightly decreasing in length from dorsalmost filament (0.9 mm long) to ventralmost one (0.7 mm long); all filaments light grayish-brown, gradually tapered toward apex; dorsalmost and ventralmost filaments not so diverged basally (at angle of about 45 degrees) when viewed laterally; cuticular surface with very distinct annular ridges and furrows throughout their length, covered with minute tubercles of different sizes, relatively larger ones on ridges forming reticulate patterns and smaller ones on interr ridge spaces. **Abdomen.** Dorsally, segment 1 light ochereous and thinly sclerotized; segments 2–9 almost transparent; segment 1 (Fig. 6I) moderately covered with minute tubercles submedially on posterior 1/3, with 1 simple slender medium-long hairlike seta on each side; segment 2 not tuberculate, with 1 simple slender medium-long hairlike seta and 5 simple short spinous setae (of which 3 are stouter than the other 2) on each side; segments 3 and 4 each with 4 simple hooked spines and 1 simple short seta on each side; segments 5–7 bare; segment 8 with well developed spine-combs composed of 2 (left side) or 4 (right side) spines on each side and comb-like groups of minute spines in transverse row on each side; segment 9 bare and without terminal hook. Ventrally, all segments transparent; segment 4 with a few simple short setae on each side; segment 5 with pair of bifid hooks submedially and 1 simple short seta on each side; segments 6 and 7 each with pair of bifid inner and outer hooks widely spaced and 1 simple short seta on each side. Grapnel-like hooklets absent. **Cocoon** (Fig. 6J, K). Shoe-shaped, with front wall of moderate height (0.5 mm), tightly woven with no open spaces; posterior 2/5 with floor moderately woven; individual threads invisible; 2.7 mm long by 1.1 mm wide.

Male and Mature larva. Unknown.

TYPE SPECIMEN. Holotype female, reared from pupa, collected from a small stream, foot of Mt. Halcon, Dulangan III,

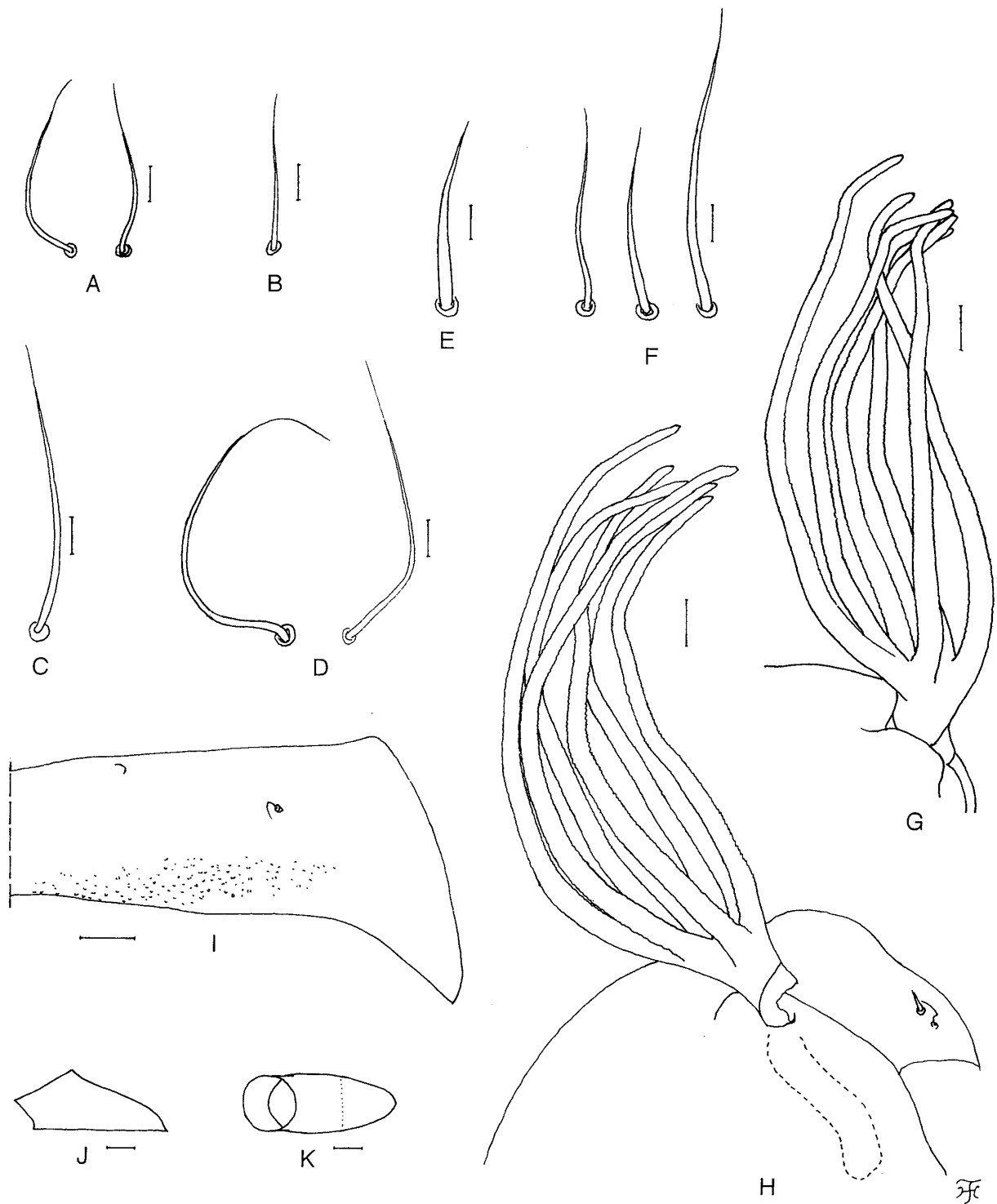


Fig. 6. Pupa of *Simulium* (*Simulium*) *halconense* sp. nov. A and B, head trichomes (A, frontal; B, facial); C-F, thoracic trichomes (C, dorsomedial; D, anterolateral; E, posterolateral; F, ventrolateral); G and H, gill filaments (right side; G, dorsal view; H, lateral view); I, dorsal surface of abdominal segment 1 showing minute tubercles on it (right half); J and K, cocoons (J, lateral view; K, dorsal view). Scale bars. 0.5 mm for J and K; 0.05 mm for G-I; 0.01 mm for A-F.

Baco, Mindoro Oriental, Philippines, 16. IX. 2006.

ECOLOGICAL NOTES. The pupa of this new species was taken from a bamboo leaf in slow-flowing small stream (width 1.5–3.0 m, shaded, water temperature 25.0°C, altitude 78 m). Associated species was *S. (S.) baltazarae*.

ETYMOLOGY. The species name *halconense* refers to the name of the mountain, Halcon.

REMARKS. This new species is very similar to *S. (S.) pandum* described from northern Luzon (Takaoka, 2006a) but is easily distinguished by the following characters (those of *S. (S.) pandum* in parentheses): in the female, length/width ratio of the fore basitarsus 4.6 (3.9), posteriorly-projected lobes of the eighth sternite fused to the ovipositor valves slightly bent ventrally (acutely bent ventrally), width/length ratio of the paraproct 1.82 (2.64), and width/length ratio of the cercus 1.8 (4.8), and in the pupa, 2 frontal trichomes (although only on left side) very widely separated from each other (somewhat separated) and dorsomedial trichomes on the thorax two pairs (three pairs). This new species is also very similar in the female to *S. (S.) suplidoi* from Negros Island (Takaoka, 1983) but is distinguished in the pupa from the latter species by the frons densely and uniformly covered with tubercles (sparsely on the dorsal area in *S. (S.) suplidoi*), and by the frontal trichomes in one or two pairs (in three pairs in *S. (S.) suplidoi*).

6. *Simulium (Simulium) taalense* Takaoka

Simulium (Simulium) taalense Takaoka, 1983: 107–109.

SPECIMENS EXAMINED. 5 females and 2 males, all reared from pupae, and 8 mature larvae, collected from the same

main channel as noted for *S. (G.) baisasae*.

DISTRIBUTION. Philippines [Luzon and Mindoro (**new record**)]

7. *Simulium (Wallacellum) suyoense* Takaoka

Simulium (Wallacellum) suyoense Takaoka, 2006b: 329–348.

SPECIMENS EXAMINED. 1 male reared from a pupa, collected from a small stream (width 0.5–1.0 m, streambed rocky, water temperature 24°C, shaded, altitude 170 m) flowing down the acute slope of a natural forest, near Tamalaw Falls, Villa Flor, Puerto Galera, Mindoro Oriental, 17. IX. 2006.

DISTRIBUTION. Philippines [Luzon and Mindoro (**new record**)]

8. *Simulium (Wallacellum) tuyense* Takaoka

Simulium (Wallacellum) tuyense Takaoka, 1983: 38–39.

SPECIMENS EXAMINED. 2 females, 2 males, all reared from pupae, 2 pupal exuviae and 3 mature larvae, collected from the same stream as noted for *S. (W.) suyoense*; 1 female reared from a pupa, 1 pupa, collected from a river (width about 50 m, river bed sand and stones, water temperature 25°C, exposed to sun, altitude 130 m), foot of Mt. Halcon, Dulangan III, Baco, Mindoro Oriental, 16. IX. 2006.

DISTRIBUTION. Philippines [Luzon and Mindoro (**new record**)].

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REFERENCES

- Davies, D. M. and Györkos, H. 1987. The Simuliidae (Diptera) of Sri Lanka. Descriptions of species in the subgenera *Eusimulium* and *Gomphostilbia* of the genus *Simulium*. *Can. J. Zool.*, 65: 1483–1502.
- Delfinado, M. 1962. The Philippine species of *Simulium* (Diptera, Simuliidae). *Philipp. J. Sci.*, 89: 47–62.
- Delfinado, M. 1969. Notes on Philippine black flies (Diptera: Simuliidae). *J. Med. Entomol.*, 6: 199–207.
- Delfinado, M. 1971. Some Simuliidae and Curtonotidae from the Philippines and the Bismarck Islands (Insecta, Diptera). *Steenstrupia*, 1: 131–139.
- Takaoka, H. 1983. The Blackflies (Diptera: Simuliidae) of the Philippines. xii + 199 pp., Japan Society of the Promotion of Science, Tokyo.
- Takaoka, H. 2003. The Black Flies (Diptera: Simuliidae) of Sulawesi, Maluku and Irian Jaya. xxii + 581 pp., Kyushu University Press, Fukuoka.
- Takaoka, H. 2006a. Four new species of *Simulium* (*Simulium*) from Luzon Island, Philippines (Diptera: Simuliidae). *Med. Entomol. Zool.*, 57: 287–307.
- Takaoka, H. 2006b. Three new species of *Simulium* (*Wallacellum*) from Luzon Island, Philippines (Diptera: Simuliidae). *Med. Entomol. Zool.*, 57: 327–346.
- Takaoka, H. and Davies, D. M. 1995. The Black Flies (Diptera: Simuliidae) of West Malaysia. viii + 175 pp., Kyushu University Press, Fukuoka.